



Chapter 9

Ornithology

Table of contents

9.1	Introduction	3
9.1.1	Previous Work on the Site	3
9.2	Legislation, Policy and Guidelines	3
9.2.1	Legislation	3
9.2.2	Guidelines	3
9.3	Consultation	3
9.4	Assessment Methodology and Significance Criteria	4
9.4.1	Baseline Determination	4
9.4.2	Assessment of Effects	5
9.5	Baseline Conditions	7
9.5.1	Designations	7
9.5.2	Field Survey	7
9.6	Potential Effects	8
9.6.1	Embedded Measures	9
9.6.2	Construction Effects	9
9.6.3	Operational Effects	10
9.7	Mitigation	12
9.8	Residual Effects	12
9.9	Cumulative Assessment	12
9.10	Summary	12
9.11	References	13

List of Figures

Figure 9.1:	Survey Areas
Figure 9.2a	Vantage Points and viewsheds April to May 2018
Figure 9.2b	Vantage Points and viewsheds May to August 2018
Figure 9.2c	Vantage Points and viewsheds September 2018 to August 2019
Figure 9.3	Wildfowl and waders flights observed from vantage points
Figure 9.4a	Raptor flights observed from vantage points during the breeding season
Figure 9.4b	Raptor flights observed from vantage points during the non-breeding season
Figure 9.5	Flights and observations recorded during other surveys
Figure 9.6	Breeding bird survey results

List of Technical Appendices

Appendix 9.1	Ornithology Technical Report
Appendix 9.2	Collision Risk Modelling
Confidential Annex	Confidential Figure 1
	Confidential Figure 2



Chapter 9

Ornithology

9.1 Introduction

1. This chapter considers the potential effects of the proposed Development on birds. It details the methods used to establish the ornithological interest within the Site and its surroundings, together with the process used to determine the Nature Conservation Importance of the species and populations present. The ways in which birds might be affected by the proposed Development are explained and the significance of the potential effects of the proposed Development are considered. The potential for cumulative effects on birds is assessed.
2. The Chapter is supported by the following Technical Appendices:
 - **Technical Appendix 9.1:** Ornithological Technical Report; and
 - **Confidential Annex: Figures 1 and 2.**

9.1.1 Previous Work on the Site

3. Ornithological surveys which included the Site have previously been conducted for the initial design of the Operational Kilgallioch Windfarm during 2007 to 2009.
4. The following surveys were undertaken on/around the Site between April 2007 and October 2009:
 - Four generic vantage points (VPs) covered the Site (numbers 7A, 8, 13 and 17) and were used for flight activity survey using the methods described by Band *et al.* (2007); survey effort of at least 36 hours per season were completed from each for one non-breeding season (VP 7a, 8 and 13, September 2007 to March 2008; VP 17, September 2008 to March 2009) and for one breeding season (April 2008 to August 2008). VP 7a, 8 and 13 had an additional 15 hours for a second non-breeding season (September 2008 to March 2009) and 12.5 hours for a second breeding season (April 2009 to August 2009); VP8 and VP13 also had at least 12 hours completed during an initial breeding season during April to August 2007
 - 1 migration period watch point covered the site (point B), recording for 42 hours during autumn migration (September 2007 to November 2007) and 36 hours during spring migration (March and April 2008);
 - An additional 72.85 hours of focal watches were undertaken to search for hen harrier roosts between November 2007 and March 2008, September 2008 to March 2009 and October 2009, using survey methods given in Gilbert *et al.* (1998);
 - In addition to the generic vantage point watches, across the whole Operational Kilgallioch Windfarm site, which included the proposed Development Site, 15 hours were spent searching for evidence of scarce breeding raptors in 2007, 61.8 hours during 2008 and 170.7 hours in 2009, using survey methods given in Hardey *et al.* (2006);
 - Breeding bird territories were surveyed three times in each breeding season of 2008 and 2009, following a modified Brown and Shepherd (1993) method;
 - Black grouse surveys were carried out in April and May 2008, using survey methods based on those in Gilbert *et al.* (1998); and
 - Autumn/winter walk-over surveys (effectively mobile VP watches) were undertaken during September 2007 to March 2008 and November 2008 to January 2009.

9.2 Legislation, Policy and Guidelines

9.2.1 Legislation

5. The following legislation has been taken into account when undertaking this assessment:

- Environment Impact Directive 2014/52/EU;
- The Wildlife and Countryside Act (as amended) (WCA);
- The Conservation (Natural Habitats, &c) Regulations 1994 (as amended) ('The Habitats Regulations');
- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Council Directive on the Conservation of Wild Birds 2009/147/EC ('The EU 'Birds Directive'); and
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

9.2.2 Guidelines

6. The following guidance has been consulted while undertaking this assessment:
 - Scottish Natural Heritage (SNH) (2017), Guidance: Recommended bird survey methods to inform impact assessment of onshore wind farms;
 - SNH (2014), Guidance: Assessing significance of impacts from onshore windfarms on birds outwith designated areas (updated 2018);
 - SNH (2016), Guidance: Assessing connectivity with Special Protection Areas (SPAs);
 - SNH (2018a), Guidance: Use of avoidance rates in the SNH wind farm collision risk model;
 - SNH (2017), Natural heritage considerations for solar photovoltaic installations; and
 - BRE (2014), Biodiversity guidance for solar developments.

9.3 Consultation

7. **Table 9.1** summarises the consultation responses received from relevant regulatory consultees and provides information on where and how they have been addressed in the assessment, where relevant. Ornithological information for the area was requested from the Raptor Study Group (RSG) and the Barn Owl Trust.

Consultee	Response	Action
SNH – Scoping Opinion, letter dated 09 May 2019.	Without any specific details as to results to date SNH agree with the scope of surveys as currently described so long as they have adhered to SNH guidance. SNH note the species identified during the first non-breeding season and would strongly recommend the developer and or their consultants discuss with SNH and RSPB before second breeding/non-breeding seasons are potentially scoped out.	A further breeding season was completed in 2019.
	The scope of assessment is adequate but would add Collision Risk Analysis using the standard Band method.	Collision Risk Analysis using the Band method was completed for the species for which assessment was required (hen harrier).
Royal Society for the Protection of Birds (RSPB) – Scoping Opinion, letter dated 16 May 2019.	RSPB note that updated survey work is underway (2018/19) and that this includes vantage point survey work, one breeding season and one winter bird survey and that based on the results so far of this work that target species have been selected. While RSPB agree with the species selected, we would advise that the scoping out of species is premature until the second season of breeding bird survey work has been completed (Aug 2019).	A second breeding season has been completed.
	RSPB note that hen harrier and golden plover are the most frequently recorded species through updated survey work which corresponds with survey undertaken in 2008/09 for the Operational Kilgallioch Windfarm.	These species have been considered in the assessment.

	RSPB advise that assessment of impact to these species is given careful consideration in the EIA for the proposed Development.	
	RSPB note that it is stated that consultation will be sought with SNH and RSPB following the results of the first breeding and wintering bird survey. However, we do not have this on record and are not aware of any contact being made with us at this stage.	Consultation was undertaken in an email dated 27 September 2019 (see below).
	RSPB note that it is recommended that connectivity to the Glen App Special Protection Areas (SPA) is scoped out of this assessment due to the assessment made for the Operational Kilgallioch Windfarm that no connectivity existed. Given that this development is within 10 km (7 km) from the SPA we would advise that the assessment for connectivity remains scoped in since the distance is within foraging range for this species (SNH guidance Assessing Connectivity with Special Protection Areas (SPAs) Version 3, 2016).	The SNH Guidance states that "in most cases the core range should be used when determining whether there is connectivity between the proposal and the qualifying interests". The core range for hen harrier is stated as 2 km in the Guidance therefore this has been used to scope out connectivity.
	RSPB recommend that results of post-construction monitoring for the Operational Kilgallioch Windfarm are used to inform likely assessment of potential impact from the proposed Development.	SPR discharged the condition for operational bird monitoring, which resulted in almost all previously proposed monitoring being removed due to it being of very limited value. As such there are no bird monitoring reports for the Operational Kilgallioch Windfarm.
RSPB - email received 30 October 2019	Response to report on surveys to date and request for opinion on scoping out of second non-breeding season field surveys (email dated 27 September 2019). RSPB stated they "would agree that it should be reasonable to expect a robust enough assessment of potential impact to target species based on the data from updated survey work and past effort although we would highlight the need to thoroughly assess impact in particular to roosting hen harrier which the updated survey work has confirmed present on site".	The impacts are thoroughly assessed in this Chapter.
	"We would also advise that displacement of roosting golden plover is also assessed in line with the results of updated survey work and previous survey effort and that the omission of a second updated survey for the winter period is made clear in the EIA and that any possible limitations for final assessment of impact based on this is acknowledged".	Impacts on golden plover are assessed in this chapter,
SNH – email received 11 November 2019	Response to report on surveys to date and request for opinion on scoping out of second non-breeding season field surveys (email dated 27 September 2019). "I'm satisfied that a reasonable case has been made to justify not	Two breeding seasons and one non-breeding season of field surveys have been completed.

	<i>undertaking a second year of non-breeding surveys in the year 2019/20".</i>	
Dumfries & Galloway Raptor Study Group	Provided informal confidential information on scarce raptors in the survey area and wider area.	This information informed survey design
The Barn Owl Trust	On the request of a member of the public made during a public meeting the Barn Owl Trust were contacted for comment and information.	To date no response has been received.

Table 9.1: Consultation Responses

9.4 Assessment Methodology and Significance Criteria

9.4.1 Baseline Determination

9.4.1.1 Data Sources

8. In addition to the Guidance listed above the following data sources have been consulted to inform the assessment:

- SNH Sitelink web pages (online information about designated sites);
- The Birds of Conservation Concern (BoCC) Eaton *et al.*, 2015);
- International Union for the Conservation of Nature (IUCN) Red list of threatened species (IUCN, 2017);
- Scottish Biodiversity List (SBL) (Scottish Biodiversity Forum, 2013);
- Relevant ESs, associated documents and bird monitoring reports for nearby developments (acquired from various sources); and
- Data on relevant scarce raptor species supplied by the local RSG.

9.4.1.2 Study Area

9. The field surveys adhered to SNH Guidance current at the time of the commencement of baseline surveys (SNH, 2017).

10. The Study Area was defined with reference to the proposed Development and encompasses a series of buffers of up to 2 km radius from the main development area; with buffer size dependent on the sensitivity of key species to potential effects associated with windfarm development. The various survey areas, which make up the Study Area, are defined as follows:

- 'Site' refers to the area enclosed by the proposed Development's application boundary;
- a 500 m buffer around the proposed Development area was used for the breeding bird survey of open ground and the winter bird survey;
- a 1 km buffer around the proposed Development area was used for breeding goshawk and breeding barn owl surveys;
- a 1.5 km buffer around the proposed Development area was applied for black grouse; and
- a 2 km buffer around the proposed Development area was used for most scarce breeding raptors.

11. The Study Area for the assessment of collision risk is the 'flight activity assessment area' or 'FA' which refers to a polygon around the outermost proposed turbine locations plus an additional 500 m strip around that polygon.

12. These survey areas are indicated on **Figure 9.1**.

9.4.1.3 Field Survey

13. Baseline field surveys for the main development area of the Site were carried out between April 2018 and August 2019. A detailed methodology for all surveys is provided in **Technical Appendix 9.1** and is briefly summarised here.

14. Information on bird flight activity was collected during watches from vantage points (VPs) within and surrounding the main development area of the Site. Data were collected for all target bird species from three Generic VPs (GVPs) throughout the baseline survey period (split into breeding season and non-breeding season) with a minimum of 36 hours from each GVP per season. Surveys collated data over a 500 m buffer of the proposed turbine locations (i.e. within the FA), and for *Target A* species¹ recorded flight duration and the bird's flying elevation above the ground at 15 second intervals. For other species (*Target B*²) flights were mapped and elevation noted but not timed. Finally for species of lower conservation importance (*Target C*) a count of individuals present each five minute period was made (**Figures 9.2a, 9.2b & 9.2c**).
15. Bird distribution and abundance was determined in the breeding seasons of 2018 by carrying out walkover surveys of open ground within the 500 m survey area, to establish the breeding bird community on open ground habitats (**Figure 9.1**). Four visits were completed between April and July (with a gap of at least two weeks between each visit). The ground was covered to 100 m of all points and positions of birds were mapped and behaviour noted. A summary map was compiled after all visits showing the location of each identified territory centre.
16. Targeted watches and searches of key habitats were undertaken during the breeding season of 2018 and 2019 to look for breeding raptors and owls within the 2 km survey area and any checks of potential nests were made by licensed observers (**Figure 9.1**).
17. Checks for displaying black grouse were completed in April and May of 2018 and 2019 over habitats considered to be suitable for this species within the 1.5 km survey area (**Figure 9.1**).
18. During the non-breeding season, the bird community was surveyed by undertaking walkover surveys within the 500 m survey area (**Figure 9.1**).
19. Watches were conducted during the winter months (November 2018 to February 2019) over habitats considered to be suitable for roosting hen harriers, within the 2 km survey area (**Figure 9.1**).

9.4.2 Assessment of Effects

20. The assessment followed the process set out in *The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017* and government guidance on the implementation of the EU Birds and Habitats Directives. The process of evaluating the effects of the proposed Development on birds ensures that the consenting authority (the Energy Consents Unit in this case) has sufficient information to determine whether the proposed Development (either alone or in combination with other plans or projects) is likely to have a significant effect on bird interests.
21. Effects are evaluated against the existing baseline conditions, i.e. without the proposed Development present. If any mitigation is required this is then identified, and the effects reassessed with this included.
22. Where there is a potential effect on a bird population that forms part of the qualifying interest of an internationally or nationally designated site (or where such designation is proposed) effects are judged, so far as possible, against whether the proposed Development could significantly and adversely affect the designated site's 'population' and the objectives of the designated site's classification. Such sites include SPAs; Ramsar sites; Sites of Special Scientific Interest (SSSIs); and a site that would meet the criteria for international or national designation.
23. Where bird populations are not protected by such a designation (as listed above), then judgement is made against a more general expectation that the proposed Development would not have a significant adverse effect on the species' overall population, range or distribution; and that it would not interfere significantly with the flight paths of migratory birds.

¹ *Target A* species were drawn from those listed in Annex 1 of the Birds Directive and Schedule 1 of the WCA, and includes scarce raptor and owl species (e.g. hen harrier, merlin, goshawk, short-eared owl, barn owl) and whooper swan. See Technical Appendix 9.1 (Annex 1.6) for a full list.

24. In assessing the effects consideration is given to the national and regional populations of species. Regional populations are those occurring within the host Natural Heritage Zone (NHZ).

9.4.2.1 Impacts Assessed

25. The following potential impacts on birds resulting from the proposed Development have been initially considered for the assessment- in full, although some impacts are scoped out after baseline data collection (**Section 9.6**):
 - habitat modification due to changes in land management and hydrology during construction and operation;
 - direct habitat loss, both temporary during the construction phase and permanent during the operation phase, due to land-take by turbine bases, solar array, access tracks, and ancillary structures;
 - indirect habitat loss due to displacement of birds as a result of construction and maintenance activities or due to the presence of the operational turbines (and solar array) close to nesting, roosting or feeding sites or habitual flight routes;
 - collision with rotating turbine blades during the operational phase (i.e. killing or injuring birds); and
 - cumulative impacts within the regional population arising from the above potential impacts during the operational phase, taken along with those effects predicted for relevant developments.

9.4.2.2 Significance of Effects

26. The assessment determines the potential impacts of the proposed Development and considers the likelihood of their occurrence. Effect is defined as change in the assemblage of bird species present as a result of the impacts accrued by the proposed Development. Change can occur either during or beyond the life of the proposed Development. Where the response of a population has varying degrees of likelihood, the probability of these differing outcomes is considered. Note effects can be adverse, neutral or beneficial.
27. In assessing whether an effect is significant or not, three factors are considered:
 - the Nature Conservation Importance of the species involved;
 - the magnitude of the likely impact; and
 - the conservation status of the species.

28. The significance of potential effects is then determined by integrating the assessments of these factors in a reasoned way. The magnitude of likely impacts involves consideration of their spatial and temporal magnitudes. In making judgements on significance by this integration, consideration is given to the national and regional trends of the potentially affected species, and how the integrated impacts may impinge on the conservation status of the species involved at these geographical levels. Further details of the process underlying the assessment and the determination of significance follow.

Nature Conservation Importance

29. The Nature Conservation Importance of each species potentially affected by the proposed Development has been defined according to **Table 9.2**.

² *Target B* species were migratory birds of conservation importance, in this instance geese and certain waders (e.g. golden plover, curlew). See Annex 1.6 for a full list.

Importance	Definition
High	Species listed in Annex 1 of the EU Birds Directive. Breeding species listed on Schedule 1 of the WCA.
Moderate	Species on the BoCC 'Red list' (Eaton <i>et al.</i> , 2015) or IUCN 'Red list – Near Threatened' (IUCN 2017). Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed Development. Species present in regionally important numbers (>1 % regional population).
Low	All other species not mentioned above.

Table 9.2: Nature Conservation Importance

30. Species listed on the SBL would be considered moderately important only if the proposed Development supported at least 1 % of the regional population.

Magnitude of Impact

31. Magnitude was determined by consideration of the spatial and temporal nature of each impact. There are five levels of spatial magnitude (Table 9.3) and four levels of temporal magnitude (Table 9.4). As this is a non-designated site, spatial magnitude was assessed in respect of regional populations within the appropriate ecological unit, in this case the Western Southern Uplands and Inner Solway Natural Heritage Zone (NHZ 19) as defined by SNH (SNH, 2001).

Magnitude	Definition
Very high	Total/near total loss of a bird population due to mortality or displacement. Total/near loss of productivity in a bird population due to disturbance. Guide: >80 % of regional population affected.
High	Major reduction in the status or productivity of a bird population due to mortality, displacement or disturbance Guide: 21-80 % of regional population affected.
Moderate	Partial reduction in the status or productivity of a bird population due to mortality, displacement or disturbance Guide: 6-20 % of regional population affected.
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality, displacement or disturbance Guide: 1-5 % of regional population affected.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality, displacement or disturbance. Reduction barely discernible, approximating to the 'no change' situation. Guide: <1 % of regional population affected.

Table 9.3: Levels of spatial magnitude of impact

Magnitude	Definition
Permanent	Impacts continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need > 25 years to reach maturity, or restoration of ground after removal of a development). Such exceptions can be termed very long effects.
Long-term	Approximately 15-25 years or longer (refer to above).
Medium-term	Approximately 5-15 years.

Magnitude	Definition
Short-term	Up to approximately 5 years.

Table 9.4: Levels of temporal magnitude of impact

32. The magnitude of an impact can be influenced by when it occurs. For example, operations undertaken in daylight hours may have little temporal overlap with the occupancy of birds' night-time roosts; and seasonality in a bird population's occupancy of a site may mean that impacts are unlikely during certain periods of the year.
33. A population's behavioural sensitivity may also be considered when assessing the magnitude of effects. Behavioural sensitivity may be judged as being high, moderate or low according to the species' ecological function and behaviour. Behavioural sensitivity can differ even between similar species and, for particular species, some populations and individuals may be more sensitive than others, and sensitivity may change over time, e.g. species are often more sensitive during the breeding season.
34. Importantly, in determining behavioural sensitivity and its contribution to an impact, where such information exists from monitoring sites, data on the responses of individual birds and bird populations to windfarms and similar developments are taken into account, along with knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. birds being recruited from other populations elsewhere).

Conservation Status

35. Where the available data allowed, the conservation status of each potentially affected population was considered within the NHZ. For these purposes, conservation status was taken to mean the sum of the influences acting on a population which may affect its long term distribution and abundance. Conservation status is considered to be favourable where:
- a species appears to be maintaining itself on a long-term basis as a viable component of its habitats;
 - the natural range of the species is not being reduced, nor is likely to be reduced for the foreseeable future; and
 - there is (and will probably continue to be) sufficient habitat to maintain the species' population on a long-term basis.

Determining Significance of Potential Effects

36. Following the classification of each species' Nature Conservation Importance i.e. (High, Moderate or Low) and consideration of the magnitude of each impact i.e. (Very high, High, Moderate, Low or Negligible impact for Permanent, Long-term, Medium-term or Short-term duration), professional judgement is used to make a reasoned assessment of the likely effect on the conservation status of each potentially affected species (derived from available information on the NHZ population).
37. In accordance with the EIA Regulations, each likely effect is evaluated and classified as either significant or not significant. The significance levels of effect on bird populations are described in Table 9.5. Impacts resulting in detectable changes in the conservation status of regional populations of Nature Conservation Importance are automatically considered to be significant effects for the purposes of the EIA Regulations (i.e. no distinction is made between effects of "major" or "moderate" significance). Non-significant effects include all those which are likely to result in small to barely detectable (minor) or non-detectable (negligible) changes in conservation status of regional (and therefore national) populations.

Significance level of effect	Description
Major	Detectable changes in regional populations of Nature Conservation Importance that would have a severe impact on conservation status.
Moderate	Detectable changes in regional populations of Nature Conservation Importance that would likely have an impact on their conservation status.
Minor	Small or barely discernible changes that would be unlikely to have an impact on the conservation status of regional populations of Nature Conservation Importance.

Significance level of effect	Description
Negligible	No or non-detectable changes in conservation status of regional populations of Nature Conservation Importance.

Table 9.5 Significance levels of effects on birds

9.4.2.3 Requirements for Mitigation

38. Following the identification of the potential effects, this Chapter will then identify mitigation measures if any of the potential effects on features of Nature Conservation Importance are determined to be significant. These measures will aim to avoid, reduce, or remedy the effects where possible.

9.4.2.4 Assessment of Residual Effects

39. The residual effects of the proposed Development are those effects remaining after mitigation. The residual effects have been assessed following the methodology for the assessment of potential effects but taking into consideration any proposed mitigation and enhancement.

9.4.2.5 Assessment of Cumulative Effects

40. The assessment of cumulative effects is undertaken in a similar manner to that of the potential 'in isolation' effects for the proposed Development but takes into consideration other operational, consented or within-planning windfarm developments. Developments within scoping are not considered.

41. SNH Guidance (SNH, 2018b) on assessing cumulative effects has been followed. In considering cumulative effects it is necessary to identify any effects that are minor, or greater, in isolation (**Table 9.5**) but that may be significant when added together.

9.4.2.6 Limitations to the Assessment

42. There are no known information gaps or shortfalls in the data. The available information on bird populations at the NHZ level is limited and available information on the results of monitoring, mitigation and enhancement work at existing windfarm developments is sparse. Therefore, the best use is made of the available literature and professional judgement to inform the assessment.

9.5 Baseline Conditions

43. This section summarises the baseline bird populations and flight activity within and surrounding the proposed Development based on surveys undertaken in the period April 2018 to August 2019. Details of methods and full results are presented in **Technical Appendix 9.1**.

44. The Site comprises open moorland of rough grass and heather patches, and rough grazing. The Site is surrounded by commercial plantation forestry at various stages of its lifecycle. The habitats within the ornithology 2 km buffer of the Site include plantation forestry, and open moorland, some areas of both are occupied by existing operational windfarms.

9.5.1 Designations

45. The Site is not statutorily designated at international or national levels for ornithological interests. The nearest designated areas for birds are the Glen App and Galloway Moors Special Protection Area (SPA) (approximately 7.5 km west at its nearest point) which is designated for breeding hen harrier (*Circus cyaneus*).

46. SNH Guidance on connectivity to SPAs (SNH, 2016) states that "...in most cases the core range should be used when determining whether there is connectivity between the proposal and the qualifying interests. Maximum ranges are also provided to indicate that birds will, at times, travel further". The stated core foraging distance during the breeding season of hen harrier is 2 km. Thus, at this distance there is little probability of connectivity to the foraging range of hen harriers forming the qualifying interest of the SPA, and hence a Habitats Regulations Assessment (HRA) is not required.

47. In their Scoping Opinion (Kilgallioch Windfarm Extension, Scoping Opinion, 2019), SNH stated that the "scope was adequate". The scope included, in relation to the Glen App and Galloway Moors SPA that direct effects on the designated site were to be scoped out of the assessment, this is taken as agreement that an HRA is not necessary.

9.5.2 Field Survey

9.5.2.1 Wildfowl

48. Whooper swan (*Cygnus cygnus*), greylag goose (*Anser anser*) and pink-footed goose (*Anser brachyrhynchus*) were recorded (**Figure 9.3 & 9.5**). Whooper swan is listed on Annex 1 of the Birds Directive, and Schedule 1 of the WCA, and all are regular winter migratory species in the UK and as such are afforded protection under the Birds Directive.

49. A group of three whooper swans was seen twice on the Loch Eldrig in November and December 2018.

50. Two flights by greylag goose, involving a total of seven birds, flew within the FA (500 m buffer of the proposed turbines) at collision risk height (i.e. between 30 m and 200 m elevation, the flight height recording bands which cover the dimensions of the turbine rotor blades) (**Figure 9.3**).

51. One pink-footed goose flight of 90 birds passed within the FA, above collision risk height (**Figure 9.3**).

52. Given the absence of flight records by these species within the FA over the course of baseline surveys and the species' low reliance on the water bodies in the vicinity of the proposed Development, a detailed assessment of potential effects on these species arising from the proposed Development are not required under the EIA Regulations. Hence, despite their Nature Conservation Importance (NCI) (**Table 9.2**) whooper swan (high NCI), pink-footed goose (moderate NCI) and greylag goose (moderate NCI) are not considered further in this assessment.

9.5.2.2 Scarce Raptors and Owls

53. Goshawk (*Accipiter gentilis*), hen harrier (*Circus cyaneus*), merlin (*Falco columbarius*), peregrine (*Falco peregrinus*), red kite (*Milvus milvus*), short-eared owl (*Asio flammeus*) and barn owl (*Tyto alba*) were recorded (**Figures 9.4a, 9.4b & 9.5**). All these species except goshawk and barn owl are listed on Annex 1 of the Birds Directive and all except short-eared owl are listed on Schedule 1 of the WCA. Hen harrier and merlin are also BoCC Red-listed species.

54. In 2018 and 2019 one barn owl nest site was found and birds were present, however there was no evidence that breeding occurred in either year. There was no evidence of any of the other species breeding within the survey area (**Confidential Annex: Figure 1**).

55. Hen harriers used three areas for winter roosts during 2018/2019 (A, B and C); of which two (A and B) were used regularly by two individuals and up to four individuals through the winter; these areas were very similar to those identified during the surveys for the Operational Kilgallioch Windfarm in the winters of 2007/2008 and 2008/2009, and lie within the 500 m buffer of the proposed turbine locations, the closest is approximately 215 m from the nearest turbine location (**Confidential Annex: Figure 2**).

56. Sixteen hen harrier flights were recorded within the FA for a total duration of 1,631 seconds. Of this duration, 96 seconds (6 %) of flight was recorded at a height that places them at risk of collision with the turbine blades, i.e. between 30 – 200 m above ground level (**Figure 9.4a & 9.4b**).

57. Due to the winter roost and flight activities of hen harrier this species will be considered further.

58. One flight by goshawk, two by red kite, one by merlin, two by peregrine and two by short-eared owl were recorded within the FA. All flights by goshawk, merlin and short-eared owl were below the collision risk height. (**Figure 9.4a & 9.4b**).

59. No evidence of breeding by goshawk, red kite, merlin, peregrine or short-eared owl was obtained, despite searches in potential breeding habitat, within 2 km of the Site (1 km for goshawk). Given this, and the very low level of flight activity within or close to the FA, there is deemed to be no prospect of the proposed Development affecting the

regional populations of these species. Hence, despite their high NCI (**Table 9.2**) these species are not considered further in this assessment.

60. Barn owl is a species of high Nature Conservation Importance (**Table 9.2**). However, it is also very tolerant of human activities and so potential for disturbance impact during construction and operation is intrinsically low. One barn owl breeding site was located; however there was no evidence that breeding occurred in 2018 or 2019. The breeding site is located at a distance c.500 m from the nearest proposed turbine. No further suitable nest sites were identified (see **Confidential Annex: Figure 1**) and so no nest sites (and associated foraging ranges: Bunn *et al.*, 1982) were within a distance at which any substantive disturbance could occur as a result of the proposed Development, regardless of any habitat modifications connected with the proposed Development. Moreover, barn owls generally fly below collision risk height when foraging, so potential for collision is also low. Therefore, as barn owls would not be adversely affected by the proposed Development, this species is not considered further in this assessment.

9.5.2.3 Black Grouse

61. There were no records of black grouse during the surveys. Due to this species not being present in the area it is not considered further in this assessment.

9.5.2.4 Waders

62. Golden plover (*Pluvialis apricaria*), snipe (*Gallinago gallinago*), jack snipe (*Lymnocyptes minimus*) and woodcock (*Scolopax rusticola*) were recorded (**Figure 9.3, 9.5 & 9.6**). Golden plover is listed on Annex 1 of the Birds Directive and woodcock is a Red-listed Bird of Conservation Concern. Snipe possibly bred within the 500 m survey area, with no other species recorded during the breeding bird surveys.

63. Non-breeding golden plovers were recorded occasionally within the survey areas and this species was absent between May and September of both years. Twenty-four flights by a total of 769 golden plover (flock sizes ranged from 2 to 200 birds) passed within the FA; of these, fourteen flights (involving a total of 554 birds) were at collision risk height. (**Figure 9.3**). It should be noted that this total count of birds was comprised of a number of flights made by the same birds on a number of occasions during a small number of watches through the non-breeding season. Hence the total number of golden plovers using the area was less, with a maximum of 200 individuals present in January 2019, but counts over the rest of the season much lower than this (see **Appendix 9.1**).

64. For woodcock, snipe and jack snipe there are no substantial indications of overwintering, migration or breeding by any of these species and they are not considered further within this assessment.

9.5.2.5 Other Species

65. Selected species of interest include: buzzard (*Buteo buteo*), kestrel (*Falco tinnunculus*), raven (*Corvus corax*), common gull (*Larus canus*), skylark (*Alauda arvensis*), red grouse (*Lagopus lagopus*), cuckoo (*Cuculus canorus*), reed bunting (*Emberiza schoeniclus*) and grasshopper warbler (*Locustella naevia*) (**Figure 9.6**). Cuckoo, skylark and grasshopper warbler are red listed BoCC and along with red grouse and reed bunting are also listed on the SBL. A small colony (around 6 to 8 pairs) of common gulls nests on the island in Loch Eldrig. However, these species are either of low Nature Conservation Importance or present in such low numbers that any effects on regional populations are considered implausible; hence none are considered further in this assessment.

9.5.2.6 Summary Results from Survey work completed in 2007 to 2009

66. The full results are described in the Operational Kilgallioch Windfarm Environmental Statement and associated appendices and are summarised here to provide context for the current surveys and their data.

67. Hen harriers foraged around the outside of the forest within the environs of the Site. Flight time across the whole Operational Kilgallioch Windfarm site, which initially included the area of the proposed Development, comprised c.0.1 % of observation time, with only 4 % of flight time being between 50 m and 150 m above ground level. There were no nests of hen harrier located within any of the 2 km buffered survey areas.

68. Two winter roost locations were found to be used by one or two individual hen harriers. One was used in both winters (2007/2008 and 2008/2009) whilst the other was used during 2007/2008 only.

69. Merlin had 9 flights recorded in total within the Site. No merlin nests were found within the 2 km buffered survey boundaries. No peregrine, osprey, short-eared owl or red kite flights were recorded within the Site. No nests of any of these species were located during surveys.

70. Barn owls nested successfully in all 3 years in one location within a 1 km buffer of the main development area of the Site. Seven flights were observed within 1 km of the main development area of the Site in the breeding season with no activity between 50 m and 150 m above ground level. Only 2 flights were recorded during the non-breeding season, again with no activity between 50 m and 150 m above ground level.

71. Golden plovers were present during the non-breeding season (maximum count about 150 birds). They occurred in three locations surveyed, one of which was the main development area of the Site.

72. Within 500 m of the main development area of the Site, curlew were recorded as having two breeding territories in 2008 and none in 2009; snipe had four territories in 2008 and six during 2009. No oystercatcher or lapwing territories were recorded.

73. There were very few flights of geese or swans recorded during the whole survey period, and the main development area of the Site does not lie on a regular flight route for migratory or wintering wildfowl.

74. There were no black grouse or signs of black grouse located in any survey. No nightjars were recorded on night-time searches. Woodcock (25 records) were recorded on winter transects.

9.6 Potential Effects

75. On the basis of the desk based and field survey work undertaken, the professional judgement of the ornithology team, experience from other relevant projects and policy guidance and standards, the following topic areas have been scoped out of the assessment:

- effects on internationally and nationally designated sites for birds: the distance to the nearest SPAs and SSSIs are such that no species cited as a qualifying interest for these sites would be affected by the proposed Development to the detriment of the conservation objectives of the designated sites (i.e there would be no likely significant effect);
- effects arising from habitat modification during construction and operation. No major changes to the current land management regime of the Site are anticipated as a result of the proposed Development. Therefore, bird populations would be unaffected by habitat modification;
- effects on the following bird populations: whooper swan, pink-footed goose, greylag goose, red kite, peregrine, merlin, goshawk, barn owl, short-eared owl, black grouse, golden plover, woodcock, snipe, jack snipe and all passerine species. Baseline field studies and consultations revealed very infrequent use of the Site by certain species of high and moderate Nature Conservation Importance (see **Table 9.2**). Although these species, or species groups, were recorded, their reliance on habitats and airspace in the vicinity of the proposed Development is so low that there is no potential for an adverse effect on regional or national populations as a result of construction or operational activities (see **section 9.5: Baseline Conditions**); and
- effects on all bird species classified as low Nature Conservation Importance.

76. The assessment of effects is based upon the proposed Development description outlined in **Chapter 4: Development Description** and is structured as follows:

- construction effects of the proposed Development;
- operational effects of the proposed Development; and
- cumulative effects of the proposed Development.

77. Potential effects are evaluated in respect of regularly occurring species of high and moderate Nature Conservation Importance, whose regional populations could be potentially affected by the proposed Development (**Table 9.6**). Consideration has been given to the criteria in **Table 9.2** when assigning the Nature Conservation Importance of

potentially affected species. For the proposed Development two species requires further consideration, hen harrier and golden plover.

Importance	Species
High	hen harrier; golden plover
Moderate	N/A
Low	N/A

Table 9.6: Nature Conservation Importance of Potentially Affected Species

Hen Harrier

78. Hen harrier is listed on *Annex 1* of the Birds Directive and on *Schedule 1* and *Schedule 1A* of the WCA, and is a Red listed BoCC, and therefore is a species of high NCI. Breeding hen harrier is the qualifying species for the Glen App and Galloway Moors SPA. It is a widespread but scarce breeding species in Scotland. A small number of hen harriers use winter roosts in the survey buffer of the Site and flight activity was also recorded within the FA but no breeding was found within the 2 km survey buffer.
79. This ground nesting species feeds on small to medium live prey and is closely associated to heather moorland and newly afforested uplands for breeding. In the milder parts (including the south-west of Scotland) the majority of adults are resident. In the autumn and winter a sizeable proportion of the population moves to lower altitudes hunting over open country such as rough grassland, cultivated farmland and marsh, and roost on the ground in long heather or wet rushy areas and may form communal roosts (Forrester *et al.*, 2007). Adult and juvenile survival rates are 0.81 and 0.22 (to age two) respectively (Robinson, 2005).
80. In 2015 the number of breeding pairs of hen harrier in NHZ19 was estimated at 18 (Wilson *et al.*, 2015), although this is thought likely to be an underestimate, with far more birds visiting the NHZ during the winter months. The hen harrier population monitored in Dumfries and Galloway in 2017 was 17 pairs with productivity of 2.8 per occupied home range monitored (Challis, 2018). Therefore the hen harrier population in this area is at a minimum maintaining itself, therefore the conservation status of hen harrier is favourable.

Golden Plover

81. Golden plover is listed on Annex 1 of the Birds Directive, and therefore is a species of high NCI. It is a widespread breeding bird in the uplands of Scotland. In winter, most move short distances to coastal locations, with fewer moving further south. These birds are joined by immigrants, predominantly from Iceland. Small numbers are present during the non-breeding period in the survey area of the proposed Development, but do not breed there.
82. Birds breeding in Scotland move mostly short distances to their wintering grounds within Scotland. Post breeding flocks form on the coast from mid-July to September and are joined by birds from Iceland from mid-September to mid-October. Individuals remain throughout the winter, though some may travel further south. A northward movement in Scotland commences usually during April and birds return to Iceland in early to mid-May (Forrester *et al.*, 2007).
83. The most recent estimate of the NHZ 19 breeding population in 2015 was estimated at 778 breeding pairs (this was based on predictions from a habitat model using bird distribution data from 2009 (Wilson *et al.*, 2015). The BTO Wetlands Birds Survey (WeBS) for Dumfries and Galloway wintering population estimates a five year mean in 2017/2018 as around 7,266 birds (Frost *et al.*, 2019). However, these counts are for coastal sites and so omit any from inland areas so this is an underestimate. In the UK it is on the green list of Birds of Conservation Concern (least concern). Based on the available information the population status of golden plover in this area in breeding and non-breeding periods seems to be stable and thus can be stated as favourable.

9.6.1 Embedded Measures

84. The assessment has been undertaken under the assumption that a Bird Protection Plan (BPP), devised in consultation with Dumfries and Galloway Council and SNH, would be in place prior to the onset of construction activities. The BPP will describe survey methods for the identification of sites used by protected birds and will detail

protocols for the prevention, or minimisation, of disturbance to birds as a result of activities associated with the proposed Development. The BPP would be overseen by the Ecological Clerk of Works.

85. The BPP will include a description of surveys to locate the nests or other key sites (e.g. roosts) of birds listed in *Schedules 1* and *1A* of the Wildlife and Countryside Act, 1981, in advance of construction works progressing within the Site. In the event that an active nest of a *Schedule 1* species is discovered within distances given by Ruddock & Whitfield (2007) (or within a 500 m radius of the nest for *Schedule 1* species not listed), a disturbance risk assessment will be prepared under the BPP and any measures considered necessary to safeguard the breeding attempt (e.g. exclusion zones or restrictions on timing of works), would be submitted to SNH for agreement before recommencing work.
86. Should the nest of any other wild bird not listed on *Schedule 1* be located, construction activities within 50 m of the nest site should be halted and the Ecological Clerk of Works (EcoW) informed immediately. A disturbance risk assessment should be undertaken and any measures considered necessary to prevent disturbance to the nest site be implemented. For some species breeding in some locations, no actions may be necessary but for others, buffers may be required around the nesting attempt to prevent unnecessary disturbance until the nest is no longer active.
87. During the design process, in addition to the buffers for construction periods, turbine and solar array locations were kept at least 200 m from the main hen harrier roost locations identified in surveys, to reduce the potential for disturbance during operation (**Confidential Annex: Figure 2**).

9.6.2 Construction Effects

9.6.2.1 Direct Habitat Loss

88. Full details of habitat loss are discussed in **Chapter 8: Ecology and Biodiversity**. In summary, land take as a result of construction of the proposed Development would amount to up to 38.69 ha of permanent loss comprising of blanket bog and modified bog, as well as around an additional 7.44 ha under the solar arrays. There is an abundance of similar habitats within the Site and these are not considered of critical value to hen harrier or golden plover (**Table 9.6**). Furthermore, the effect of this habitat loss is spatially negligible in relation to the home range requirements of hen harrier. Hence there will be no change in the conservation status of potentially affected species as a result of habitat loss and the effects of direct habitat loss on all ornithological interests are **negligible** and **not significant** under the EIA Regulations.

9.6.2.2 Displacement

89. The construction activities of the proposed Development, including the construction of the Site access tracks, solar arrays, turbine hard-standings and erection of the turbines is expected to last a total of 18 months. The number of bird breeding or non-breeding seasons potentially disrupted by construction activities would depend on the month in which construction works begin and the components of the proposed Development. For the purposes of this assessment a worst case scenario is assumed: i.e. that construction work would start at a time when either breeding or roosting would be potentially affected for up to two seasons. Breeding and roosting could also be affected along the main access route used by construction traffic accessing the area of the turbines and solar arrays.
90. The impacts on birds most likely to occur during the construction phase are those of indirect habitat loss due to displacement of birds through disturbance by activity of people and machines in the vicinity of the proposed Development. It is likely that noise and visual disturbance associated with construction activities could temporarily displace some of the breeding, roosting and foraging birds present, dependent on their behavioural sensitivity to human activities. Birds that are disturbed at breeding sites are vulnerable to a variety of potential effects on breeding performance, including the chilling or predation of exposed eggs/chicks, damage to or loss of eggs/chicks caused by panicked adults and the premature fledging of the young. Birds disturbed when foraging during the breeding season may also feed less efficiently and thereby breed less successfully. These impacts may lead to a short-term reduction in the productivity of bird populations. Birds disturbed during winter roosting are less constrained by location than breeding birds.
91. Disturbance effects on breeding birds would be confined to areas in the locality of the turbine layout, solar array and associated infrastructure, with different species varying in their sensitivity. Larger bird species, those higher up the food chain e.g. most raptors, or those that feed in flocks in the open tend to be more susceptible to disturbance than small birds living in structurally complex or closed habitats (e.g. woodlands) (Hill *et al.*, 1997).

Hen Harrier Breeding

92. No hen harriers were found breeding within 2 km of the proposed Development main development area so are not required to be assessed in this Chapter. Any breeding attempts by hen harriers which may occur within the vicinity of proposed construction activities would be identified during pre-construction surveys detailed in the BPP for the Site. The BPP would then detail appropriate measures to avoid construction disturbance to the breeding attempt in compliance with legislation.

Hen Harrier Winter Roosts

93. Three areas (A, B and C, **Confidential Annex: Figure 2**) were identified as having been used as winter roost sites by hen harrier, and two of these areas (A and B) had previously been identified as intermittently in use during 2007 to 2009 (Operational Kilgallioch Windfarm Environmental Statement, 2010)..
94. The roost locations appear to be used sporadically by a small number of birds: 2 adult males observed having emerged from most probably location B in November 2018; one emerging from location A in December 2018; and two (an adult and an immature male) from location A in January 2019. The roost location which seems from these data to be favoured (location A) is c.300 m from the closest turbine location and is at the outer edge of the proposed Development layout, with open access unencumbered by any infrastructure to the south.
95. There is little information on disturbance of roosting hen harriers at windfarms, however evidence from a number of windfarms shows that hen harriers will nest close to construction activities. For example, hen harriers began nesting adjacent to the Cruach Mhor Windfarm in the year of construction, with nests as close as 300 m from construction activity (Robson, 2012), and habitat adjacent to the Paul's Hill Windfarm supported nesting hen harriers within 200 m of construction activities (Robinson & Lye, 2012). Hence, on this evidence, it follows that roosting birds could also be tolerant of construction activity.
96. However, if harriers were disturbed by construction activities from the roost areas nearest the proposed Development (location A and B) there is other suitable habitat in the wider area which they currently use, further from the majority of the infrastructure (location C). There are also other known roost locations within a few kilometres of the Site. This illustrates the nearby habitat is suitable to provide alternative roost locations should the birds be disturbed during the construction period.
97. If construction activities displaced roosting hen harriers during the non-breeding season, and they were disturbed from using all three locations identified during the surveys, this would occur for at most no more than two non-breeding seasons (dependent on the month which construction commenced). This temporally short-term negative effect would affect a small number of birds, i.e. based on the most recent data most probably two but possibly a maximum of four individuals used the roost locations sporadically over the course of the non-breeding season. Discounting the additional birds which move to the region to over-winter, an estimated minimum wintering NHZ population of 83 (based on the NHZ estimate of 18 breeding pairs with a productivity of 2.8 per attempt) would suggest that at most between 2 % and 5 % of this population would be affected, which would be low spatial magnitude. These displaced birds would likely remain in the wider area and be able to find other suitable roost locations, so any impact on their survival and productivity would be minimal.
98. In summary, at worst, short-term displacement from roosting sites during construction for the hen harrier (high NCI) would affect a small proportion of the regional population (low spatial magnitude) for at most 2 non-breeding seasons (short-term temporal magnitude). Construction effects on hen harrier are predicted to be at worst **minor** and **not significant** under the EIA regulations.

Hen Harrier Foraging

99. Foraging hen harriers may be disturbed during construction. More flight activity was recorded during the non-breeding season. Hen harriers will use a larger foraging range during the non-breeding period being less constrained by providing for nestlings. Therefore the Site will form a small part of their total wintering range. As a result, foraging displacement from the area around construction activities would have little impact on this non-breeding component of the hen harrier population which would compensate for any losses in foraging habitats by exploiting other abundant areas of suitable wintering habitat elsewhere in the region.

100. Construction activities would probably displace foraging hen harriers from immediately adjacent areas. However, the effects of this short-term loss in suitable foraging habitat would likely be compensated by birds exploiting suitable habitats elsewhere in their foraging range. Any short-term negative effects at these locations are not considered to be sufficient to affect regional productivity and hence the regional population and its conservation status would be unaffected (negligible spatial magnitude). Given the above, construction effects on foraging hen harriers are predicted to be **negligible** and **not significant** under the EIA Regulations.

Golden Plover

101. Non-breeding golden plover were recorded roosting within the 500 m survey area, with small numbers (up to 50 birds) recorded intermittently in two areas. Golden plovers are present in the study area for the majority of the non-breeding period so a small number (150 to 200 maximum) are presumed to over-winter in the wider area. Studies have shown that non-breeding golden plovers are displaced by operational wind farms (Hötter *et al.* 2006) so temporary displacement as a result of construction activities is predicted to occur for at least some of these birds. However, it is unlikely that the small numbers of birds involved are reliant on these specific areas for roosting and, were they displaced, could exploit suitable habitat immediately adjacent to the Site and in the wider area. Furthermore, the size of the regional non-breeding population of golden plovers is estimated as near to 8,000 birds at a minimum (based on mainly coastal surveys, with data on the number of birds using upland areas over the course of the non-breeding season scarce). Therefore, the potential short-term temporal (at most two non-breeding seasons depending on the month construction commences) effects of displacement as a result of construction activities are spatially negligible. The impact of construction activities on over-wintering golden plover (a high NCI species) is deemed to be **negligible** and **not significant** under the EIA Regulations.

9.6.3 Operational Effects

102. The impacts on birds most likely to occur during the operational phase are those of:
- direct habitat loss due to the creation of tracks, turbine bases and other infrastructure elements;
 - indirect habitat loss due to displacement of birds by the presence of operating turbines and maintenance personnel; and
 - mortality through collision with rotating turbine blades, guy-lines and fencing.
103. Operational displacement impacts are less concentrated in time and in intensity than construction impacts. Indirect habitat loss through displacement can be evident by a decline in the breeding productivity or (in extreme cases) the number of breeding territories in the vicinity of the turbines (although a movement of the affected breeding pairs or territories away from the source of disturbance may result). Displacement from areas used for feeding may also be manifest as an alteration of the flight patterns of birds which fly over the area, and this in turn, may influence survival rates and/or (for breeding birds) reproductive output through a reduction in available foraging habitat. Collision with turbine blades and other structures would be shown by the loss of birds from the population though increased mortality rates.

9.6.3.1 Direct Habitat Loss

104. As for construction effects (**Paragraph 9.6.2.1**) the effect of this habitat loss is spatially negligible in relation to the home range requirements of all potentially affected species. Hence there will be no change in the conservation status of potentially affected species as a result of habitat loss and the effects of direct habitat loss on all ornithological interests are **negligible** and **not significant** under the EIA Regulations.

9.6.3.2 Displacement

105. The presence and operation of wind turbines and solar arrays could potentially displace birds from nesting and foraging areas. Existing information (e.g. de Lucas *et al.*, 2007; Douglas *et al.*, 2011; Haworth & Fielding, 2012) and reviews of effects (e.g. Madders & Whitfield, 2006; Hötter *et al.*, 2006; Gove *et al.*, 2013; Harrison *et al.*, 2017) suggest that most birds are affected only slightly, if at all, although these effects require further study. For example, breeding birds have not been found to be completely displaced at distances greater than 300 m from a turbine (e.g. Gill *et al.*, 1996; Percival, 1998; Hötter *et al.*, 2006) although other studies suggest partial displacement effects at greater distances (Pearce-Higgins *et al.*, 2009). However, wind turbines might displace birds from much larger areas if they act as a barrier to bird movements, or if availability of suitable habitat is restricted. In addition, displacement effects may vary over time, as birds habituate to the operation of turbines or site-faithful individuals are lost from the population.

106. The evidence suggests that impacts vary between species and sites (see discussion for raptors; Madders & Whitfield, 2006). There is potential for some disruption of feeding and nesting due to increased human activity for maintenance purposes. However, this would be relatively infrequent, involve low levels of disturbance and would be restricted to areas of the Site accessible by tracks. Therefore, the overriding source of disturbance and displacement of birds during the operational period is considered to be the turbines operating (Pearce-Higgins *et al.*, 2009). Displacement effects caused by the solar arrays on hen harrier and golden plover are predicted to be **negligible** and **not significant** under the EIA Regulations.

Hen Harrier Foraging

107. There is evidence that foraging hen harriers can be displaced from the vicinity of operational turbines. Three studies, which have observed and analysed hen harrier flight activity at Scottish windfarms, concluded that hen harriers use of habitats within 100-200 m of turbines was probably reduced, but that the windfarm footprint itself continued to be used for foraging. In some instances, use of the windfarm footprint was seen to be increased, although this was likely to have been as a result of increased prey densities following construction, resulting from habitat changes, e.g. permanent removal of forests in a stage unsuitable for hen harriers (Robson, 2012).

108. More flight activity was recorded during the non-breeding season. Hen harriers will use a larger foraging range during the non-breeding period being less constrained by providing for nestlings. Therefore the Site will form a small part of their total wintering range. In addition, no nesting by harriers was found within the core foraging range of breeding hen harriers (2 km), as reflected by the small duration of flight activity in the breeding season. Therefore, as for construction activities, foraging displacement from the area around operational activities would have little impact on the hen harrier population which would compensate for any permanent losses in foraging habitats by exploiting other abundant areas of suitable habitat elsewhere in the immediate area and wider region.

109. Any temporally permanent negative effects are not considered to be sufficient to affect regional productivity and hence the regional population and its conservation status would be unaffected (negligible spatial magnitude). Therefore despite the high Nature Conservation Importance of hen harrier operational displacement effects on foraging hen harriers are predicted to be **negligible** and **not significant** under the EIA Regulations.

Hen Harrier Winter Roosts

110. Hen harriers using the winter roosts in the area may be over-winter immigrants to the region as well as regional resident birds. They may be displaced from one or more of the roost locations due to the presence of the turbines.

111. Evidence from a number of windfarms in Scotland shows that hen harriers will continue to nest in close proximity to operational windfarms, with nests located within a few hundred metres of turbines, therefore they may well continue to use winter roosts within these distances. The most frequently used roost location (A) would be 300 m from the closest turbine and would be situated on the edge of the proposed Development and hence remain unencumbered by infrastructure to birds approaching from a number of directions. A further roost location (C) would also be situated on a different edge. Roost location B would be within the turbine layout.

112. A small number of birds use the roosts regularly but intermittently: two individuals were seen at any one time, with up to four individuals estimated as using the area through the winter; roost A appeared to be used in December and January; B in November and C in September, hence the birds currently use a suite of roost locations. Therefore if hen harriers are displaced from one of the current roost locations there appears to be suitable alternative roost locations and habitat in the immediate area. If they are displaced from all roost locations there are roosts in the wider area and region which could be used and hence birds would be unlikely to be lost from the regional wintering population.

113. In summary, operation of the proposed Development would possibly displace some roosting hen harriers from immediate adjacent areas. However, the effects of this permanent loss in suitable roosting habitat would likely be compensated by birds exploiting suitable habitats elsewhere in their over-wintering range. Any permanent negative effects are at worst sufficient to affect a small proportion of the regional population's productivity (low spatial magnitude) but more likely will only affect the larger over-wintering regional population and hence the regional population and its conservation status would be unaffected (negligible spatial magnitude).

114. Therefore despite the high Nature Conservation Importance of the species operational displacement effects on hen harriers are predicted to be **negligible** and **not significant** under the EIA Regulations.

Golden Plover

115. There were small numbers (around 50 to 200) of golden plovers recorded within the 500 m survey area, with small numbers (up to 50 birds) recorded roosting intermittently in two areas. The studies from 2007 to 2009 and 2018 show that this species appears to over-winter in the vicinity in small numbers,

116. A literature review of displacement effects in non-breeding golden plovers suggested that displacement was more likely than not (Hötter *et al.* 2006). More recent observations, however, have suggested that non-breeding plovers may not be affected by the presence of operational turbines and feed, roost and fly within operational wind farms (NRP, unpublished data; Poster at the Conference on Wind Energy and Wildlife Impacts, 2011).

117. Nevertheless, the small numbers recorded roosting in the Site for part of the non-breeding season will only constitute a very small fraction of the wintering and passage populations that use the NHZ, and any displacement impacts would probably at worst incur minor disruption to winter foraging patterns. It is highly unlikely that this would materially affect the survival or condition of non-breeding golden plovers. Hence, the long-term temporal effect and negligible spatial magnitude of effect on the regional non-breeding population of golden plover (high Nature Conservation Importance) are deemed to be **negligible** overall, and **not significant** under the EIA Regulations.

9.6.3.3 Collision Mortality

118. Birds that are not displaced would be potentially vulnerable to collision with the turbines. The level of collision with wind turbines is presumed to be dependent on the amount of flight activity over the proposed Development and the ability of birds to detect and manoeuvre around rotating turbine blades. Birds that collide with a turbine are likely to be killed or fatally injured. This may in turn affect the maintenance of bird populations.

119. An increasing body of evidence suggests that birds' capacity to avoid collision with wind turbines is very high (SNH, 2018a). The indications from studies are that collisions are rare events and occur mainly at sites where there are unusual concentrations of birds and turbines, or where the behaviour of the birds concerned leads to high-risk situations (e.g. Gill *et al.*, 1996; Percival, 1998; de Lucas *et al.*, 2007). Examples include migration flyways, and where the food resource, and therefore level of bird activity, is exceptional.

Hen Harrier

120. Only 8% of the flight duration (96 seconds of 1178 seconds of flight in 108 hours total watched; 2 flights from 9) recorded for hen harrier in the non-breeding season and none of the flight duration in the breeding season (453 seconds of flight in 219 hours total watched, no flights from 7) was within the flight height bands which cover the turbine blades of the proposed turbines (30 m to 200 m) (**Technical Appendix 9.1**).

121. Collision Risk is calculated for hen harrier flight activity which occurred within the FA during the non-breeding period (see **Appendix 9.2: Collision Risk Modelling** for further detail). The flight speed used in the collision risk calculations was 12 m / second. Collision risk has been calculated assuming 99 % avoidance.

122. On the basis of applying an accepted avoidance rate of 99 % this equates to one bird colliding with a turbine approximately every 186 years.

123. The hen harrier population is in favourable conservation status; numbers a minimum of 18 breeding pairs in the NHZ; and the non-breeding population will be larger. The potential loss of one hen harrier every 186 years is of negligible magnitude and the overall adverse effect at the scale of the NHZ would be negligible.

124. Therefore, despite the high Nature Conservation Importance of hen harrier, and operational collision risk being permanent, predicted negative effects would be so low that it would be negligible spatially for the regional population and therefore operational collision risk for hen harrier is **negligible** and **not significant** under the EIA regulations.

Golden Plover

125. A maximum of 200 golden plovers were present over the non-breeding period. The majority of flights were made by smaller flocks. Twenty-four flights by a total of 769 golden plover (flock sizes ranged from 2 to 200 birds) passed

within the FA; of these, fourteen flights (involving a total of 554 birds) were at potential collision risk height (30 m to 200 m).

126. Golden plover have been shown to be adept at avoiding collision with wind turbines. Also, if they are displaced from the immediate area of the turbines the potential for collision will be concomitantly reduced.
127. An analysis of the baseline flight activity data would predict very low risk of collision mortality within the context of the NHZ wintering population (greater than 8,000 individuals, Frost *et al.*, 2019). Therefore, a detailed assessment of collision risk on this species arising from the proposed Development is not required under the EIA Regulations.
128. Hence, despite their high Nature Conservation Importance and the operational risk of collision being permanent, predicted negative effects would be so low that it would be negligible spatially for the regional population and therefore operational collision risk for golden plover is **negligible** and **not significant** under the EIA regulations.

9.7 Mitigation

129. As no predicted effects are deemed significant, no mitigation is proposed. However, as the Habitat Management Plan proposed in **Appendix 8.7** aims to restore degraded bog habitats within the Kirkcowan Flow SAC there are the likelihood of beneficial effects for birds also. The two areas proposed for restoration which lie east of the proposed Development are part of a larger area of similar habitat and so restoration will enhance the whole area. Therefore for bird species such as hen harrier and golden plover which can range over large areas, this enhancement will improve an area of habitat away from the proposed infrastructure at a scale which should beneficially affect them.

9.8 Residual Effects

130. All predicted residual effects of construction and operation of the proposed Development remain negligible and not significant under the EIA regulations.

9.9 Cumulative Assessment

131. The EIA Regulations require the cumulative effects of the proposed Development with other relevant projects or plans to be assessed. SNH guidance (SNH, 2018) on assessing cumulative effects has been followed. In considering cumulative effects, it is necessary to identify any effects that are minor (or greater) in isolation (**Table 9.5**) but that may be major cumulatively. Cumulative assessment is based on existing and consented developments in the area.
132. "Target" species were taken to be those species of high Nature Conservation Importance (**Tables 9.2** and **9.6**) for which there was some indication of a potential effect as a result of the proposed Development, which may be exacerbated cumulatively. However, for the species concerned (hen harrier and golden plover) all effects were deemed to be of negligible significance (**Table 9.5**). Both these species' regional populations are in favourable conservation status and as such, there is no credible potential for a significant cumulative effect resulting from the addition of the proposed Development to other operational, consented and proposed developments in the NHZ. The predicted in-isolation effects of the proposed Development are considered to have no potential to contribute to cumulative effects and are, therefore, negligible across all species.
133. In conclusion, for all bird species, the cumulative effects of the proposed Development in-combination with other projects in the NHZ are predicted to be **negligible** and **not significant** under the terms of the EIA Regulations.

9.10 Summary

134. A programme of ornithological surveys was conducted at the proposed Development and within its environs from April 2018 to August 2019 in order to describe and assess the bird assemblages and flight activity throughout the year. Survey effort of flight activity over the proposed Development was 219 hours of vantage point watches over two breeding seasons and 108 hours over one non-breeding season. Vantage point surveys were undertaken from three points. Dedicated surveys of scarce breeding raptors and owls were made over two seasons with appropriately scaled buffers surrounding the proposed Development, and surveys for hen harrier winter roosts completed during the non-breeding season. Dedicated surveys for displaying black grouse were made within a 1.5 km buffer of the proposed Development in two seasons. A four-visit survey of breeding birds of open ground within a 500 m buffer of the proposed Development was conducted, and walkover surveys were conducted during the non-breeding seasons to complement breeding season surveys.
135. The bird assemblages of the proposed Development and its environs are typical of Dumfries and Galloway based on the habitats involved.
136. The proposed Development does not apparently underlie any major aerial pathways for bird movements, either for migratory birds, for breeding birds commuting between nesting and feeding sites or for overwintering birds flying between roosting and feeding locations. Wildfowl make minimal use of the airspace above the proposed Development, likely because it is not located close to or between any important roosting or feeding sites of these species.
137. Overall only two species of nature conservation importance warranted assessment of potential adverse effects, because records were too few or records involved species that are insensitive to wind farm development. The key receptor species assessed were hen harrier and golden plover, classed as of high nature conservation importance. Small numbers of hen harrier use the main development area of the proposed Development for roosting during the winter months and also forage within it and the wider area but did not breed within the survey buffers. Small numbers of golden plover use the 500 m buffer of the proposed Development for roosting during the winter only.
138. The significance of the potential effects of the proposed Development on birds was determined by considering the nature conservation importance of each key receptor species, the potential magnitude of each effect spatially and temporally, including their behavioural sensitivity to potential effects. In making judgements on significance, consideration was given to the conservation status of, and trends within, regional populations and how the proposed Development may influence change in conservation status. Detectable changes in regional populations of receptor species are automatically considered to be significant effects under the EIA Regulations (i.e. no distinction is made between effects of "major" or "moderate" significance). Non-significant effects include all those which are likely to result in barely detectable "minor" or non-detectable "negligible" changes in the conservation status of regional populations.
139. The total land-take by the proposed Development would result in the permanent loss of a very small proportion of the site's habitat. The magnitude of adverse effects on birds due to this relatively small loss is not considered to be significant for any species under the terms of the EIA Regulations.
140. Disturbance of birds during the construction phase of the proposed Development is predicted to have short-term adverse effects negligible magnitude on bird populations. Similarly, disturbance due to the operation of the proposed Development, and mortality through collision with rotating rotor blades, are predicted to have adverse effects of negligible magnitude. Overall, it is concluded that construction and operation of the proposed Development will not have a significant effect on birds under the terms of the EIA regulations. No mitigation would be necessary.
141. The contribution of adverse effects accrued by the proposed Development to regional populations will be undetectable and so cumulative effects of the proposed Development with other existing and planned wind farm developments in the region are judged unlikely to have a significant effect on existing bird populations. Overall, it is concluded that construction and operation of the proposed Development would not have a significant effect on birds

under the terms of the EIA Regulations. A summary of the potential effects on the ornithological assemblage at the Site is shown in **Table 9.7**.

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial / Adverse		Significance	Beneficial / Adverse
<i>During Construction</i>					
Direct Habitat Loss – All species	Negligible – Not Significant	Adverse	None	Negligible– Not Significant	Adverse
Displacement – hen harrier winter roosts	Minor– Not Significant	Adverse	None	Minor– Not Significant	Adverse
Displacement – hen harrier foraging	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse
Displacement – golden plover	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse
<i>During Operation</i>					
Direct Habitat Loss – All species	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse
Displacement – hen harrier foraging	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse
Displacement – hen harrier winter roosts	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse
Displacement – golden plover	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse
Collision Risk – hen harrier	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse
Collision Risk – golden plover	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse
<i>Cumulative Effects</i>					
No effects for all species	Negligible– Not Significant	Adverse	None	Negligible– Not Significant	Adverse

Table 9.7: Summary Table

9.11 References

- Bunn, D.S., Warburton, A.B. & Wilson, R.D.S. (1982). *The Barn Owl*. T & AD Poyser. Calton.
- Challis, A., Wilson, M.W., Holling, M., Roos, S., Stevenson, A. & Stirling-Aird, P. (2018). *Scottish Raptor Monitoring Scheme Report 2017*. BTO Scotland, Stirling.
- de Lucas, M., Janss, G.F.E. and Ferrer, M. (eds) (2007). *Birds and Wind Power: Risk Assessment and Mitigation*. Quercus, Madrid.
- Douglas, D.J.T., Bellamy, P.E and Pearce-Higgins, J.W. (2011). *Changes in the abundance and distribution of upland breeding birds at an operational wind farm*. Bird Study 58, 37-43.
- Eaton, M.A., Aebischer, N.J., Brown, A.F., Hearn, R.D., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D.A. and Gregory, R.D. (2015). *Birds of Conservation Concern 4: the population status of birds in the United Kingdom,, Channel Islands and Isle of Man*. British Birds 108, 708-746
- Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. & Grundy, D.S. (eds) 2007. *The Birds of Scotland*. The Scottish Ornithologists Club, Aberlady
- Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Robinson, A.E., Stroud, D.A., Wotton, S.R. and Balmer, D.E. 2019. *Waterbirds in the UK 2017/18: The Wetland Bird Survey*. BTO/RSPB/JNCC. Thetford
- Gill, J.P., Townsley, M. and Mudge, G.P., (1996). *Review of the impacts of wind farms and other aerial structures upon birds*. SNH Review 21: 68pp
- Gove, B., Langston, R.H.W., McCluskie, A., Pullan, J.D. & Scrase, I. (2013). *Wind farms and birds: an updated analysis of the effects of wind farms on birds, and best practice guidance on integrated planning and impact assessment*. Report prepared by BirdLife International on behalf of the Bern Convention. Strasbourg, 17 September 2013.
- Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. and Thompson, D. (2013). *Raptors, a field guide to survey and monitoring*. The Stationery Office, Edinburgh.
- Harrison, C., Llyod, H. & Field, C. (2017). *Evidence review of the impact of solar farms on birds, bats and general ecology*. (NEER012). Natural England. First edition.
- Haworth, P.F. and Fielding, A.H. (2012) *Edinbane Windfarm: Ornithological Monitoring A review of spatial use of the area by birds of prey* (Haworth Conservation).
- Hill, D.A, Hockin, D., Price D., Tucker G., Morris, R. & Treweek, J. (1997). Bird disturbance: improving the quality of disturbance research. *Journal of Applied Ecology* 34, pp 275-288
- Hötker, H., Thomsen, K.-M. & Jeromin, H. (2006). *Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats - facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation*. Michael-Otto-Institut im NABU, Bergenhusen
- IUCN. (2017). *IUCN Red List of Threatened Species* (ver. 2017.3). Available at: <http://www.iucnredlist.org>.
- Madders M. & Whitfield D.P., (2006). *Upland raptors and the assessment of wind farm impacts*. Ibis 148 (Suppl. 1), 43-56.
- Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. and Bullman, R. (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology* 46, 1323-1331

Percival, S.M. (1998). *Birds and Turbines: managing potential planning issues*. Proc. of the 20th BWEA Conference 1998: pp 345-350

Robinson, R.A. (2005) *BirdFacts: profiles of birds occurring in Britain & Ireland*. BTO, Thetford (<http://www.bto.org/birdfacts>, accessed on 21/06/2019)

Robinson, C. and Lye, G. (2012). *Paul's Hill wind farm - flight activity and breeding success of hen harrier*. SNH Sharing Good Practice Workshop - Assessing the impact of windfarms on birds, 3 April 2012. <http://www.snh.gov.uk/docs/A694304.pdf>

Robson, P. (2012). *Hen Harrier activity at Cruach Mhor windfarm. Review of monitoring data 2001-2011*. SNH Sharing Good Practice Workshop - Assessing the impact of windfarms on birds, 3 April 2012. <http://www.snh.gov.uk/docs/A689039.pdf>

Ruddock, M. & Whitfield, D.P. (2007). *A review of disturbance distances of selected bird species*. Report to Scottish Natural Heritage, NRP Ltd

SNH. (2001). *Natural Heritage Zones: a national assessment of Biodiversity* (Habitats).

SNH. (2017). *Recommended bird survey methods to inform impact assessment of onshore wind farms*. SNH Information and Guidance Note. SNH, Battleby

SNH. (2016). *Assessing Connectivity with Special Protection Areas (SPAs)*. SNH Information and Guidance Note. SNH, Battleby.

SNH. (2018). *Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model*. SNH Information and Guidance Note. SNH, Battleby.

SNH. (2014). *Assessing Significance of Impacts from Onshore Windfarms on Birds outwith Designated Areas* (2014, updated 2018). SNH Information and Guidance Note. SNH, Battleby.

SNH. (2018). *Assessing the cumulative impact of onshore wind energy developments*. SNH Information and Guidance Note. SNH, Battleby

SNH (2017) *Natural heritage considerations for solar photovoltaic installations*. SNH Information and Guidance Note SNH, Battleby.

Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). *Natural Heritage Zone Bird Population Estimates*. SWBSG Commissioned report number SWBSG_1504. pp72

Kilgallioch Windfarm Extension Project Team

ScottishPower Renewables
9th Floor Scottish Power Headquarters
320 St Vincent Street
Glasgow
G2 5AD

kilgalliochextension@scottishpower.com

